PROPERTIES OF A TRIG FUNCTION

For trig equations of the form:

$y = A\sin[\,B(x + C)] + D$ or $y = A\cos[\,B(x + C)] + D$

A = amplitude
= height above the mid-line of the graph

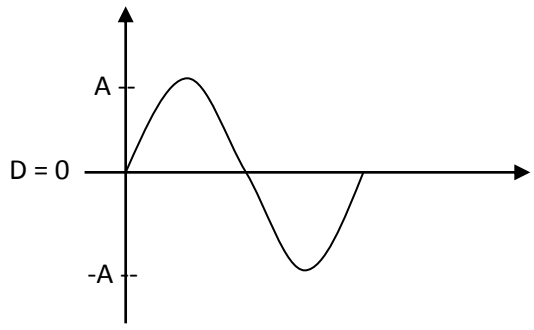
B = frequency constant
= how many cycles the graph makes in a 360° or 2π interval
= how many times the graph repeats itself in a 360° or 2π interval

T = period
= $\frac{2\pi}{B}$ (for sine and cosine graphs only. The period of a tan graph is $\frac{\pi}{B}$)
= the time it takes for the graph to complete one cycle

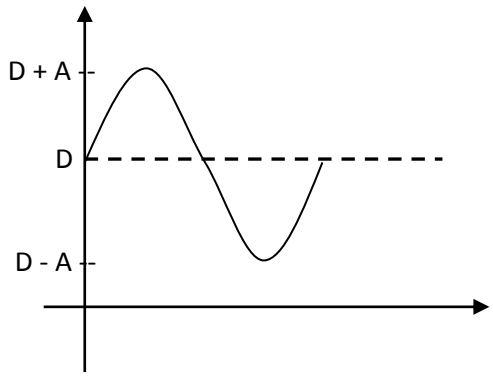
C = horizontal translation
= $+C$ means translation to the **LEFT**
= $-C$ means translation to the **RIGHT**

D = vertical translation
= also known as the mid – line
= $+D$ means translation **UP**
= $-D$ means translation **DOWN**

To work out the maximum and minimum y-values of your trig equation/graph:



$y_{max} = D + A = 0 + A = A$
$y_{min} = D - A = 0 - A = -A$



$y_{max} = D + A$
$y_{min} = D - A$

DISPLAYING TRIG EQUATIONS ON A GRAPHICS CALCULATOR

Sketch these trig equations on a graphics calculator, to display one complete cycle. All graphs should be in radians, unless stated otherwise.

Also, state what the values of A, B, C and D are for each of the equations. Make sure the equations are in the form $y = A\sin[B(x + C)] + D$ or $y = A\cos[B(x + C)] + D$.

Viewing Window Settings (to display only one cycle)

$x_{min} = 0$

$x_{max} = \frac{2\pi}{B}$ (the period of one cycle) or $\frac{360^\circ}{B}$ if in degrees. For tan it is $\frac{\pi}{B}$ of $\frac{180^\circ}{B}$.

$y_{min} = D - A$

$y_{max} = D + A$

1) $y = 2\sin\left(\frac{1}{2}x\right)$

$A = 2,\ B = \frac{1}{2},\ C = 0,\ D = 0$

$x_{min} = 0$

$x_{max} = \frac{2\pi}{\frac{1}{2}} = 4\pi$

$y_{min} = -2$

$y_{max} = 2$

2) $y = -3\cos\left(\frac{\pi x}{2}\right)$

$A = -3,\ B = \frac{\pi}{2},\ C = 0,\ D = 0$

$x_{min} = 0$

$x_{max} = \frac{2\pi}{\frac{\pi}{2}} = 4$

$y_{min} = -3$

$y_{max} = 3$

3) $y = 3\cos\ (x - \frac{\pi}{2})$

$A = 3,\ B = 1,\ C = -\frac{\pi}{2},\ D = 0$

$x_{min} = 0$

$x_{max} = \frac{2\pi}{1} = 2\pi$

$y_{min} = -3$

$y_{max} = 3$

4) $y = \frac{1}{2}\sin 2x + 1$ should be written as $y = \frac{1}{2}\sin\ (2x) + 1$

$A = \frac{1}{2},\ B = 2,\ C = 0,\ D = 1$

$x_{min} = 0$

$x_{max} = \frac{2\pi}{2} = \pi$

$y_{min} = 0.5$

$y_{max} = 1.5$

5) $y = 2\sin\ 3(x + 180°)$

$A = 2,\ B = 3,\ C = 180°,\ D = 0$

$x_{min} = 0$

$x_{max} = \frac{360°}{3} = 120°$

$y_{min} = -2$

$y_{max} = 2$

6) $y = -\cos\ (2x - \frac{\pi}{2})$ should be written as $y = -\cos 2(x - \frac{\pi}{4})$

i.e factorise by taking out the common factor of B (the coefficient of x). Only then does this give you the correct value of C.
C is NOT –π/2, it should be –π/4.

$A = -1,\ B = 2,\ C = -\frac{\pi}{4},\ D = 0$

$x_{min} = 0$

$x_{max} = \frac{2\pi}{2} = \pi$

$y_{min} = -1$

$y_{max} = 1$

Delta Ex 33.2 pg 309 – 310, Q8.